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The role of Magnetic Resonance Imaging in Diagnosis of Knee Joint Anterior Cruciate Ligament Tear in Traumatic Patients in Sulaimani

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Abstract

Background: *The traumatic or degenerative internal derangement of the knee is a common entity and may require certain studies for the establishment of diagnosis, in addition to clinical history and a thorough physical examination.* ***Objective***: *To assess the role of MRI in diagnosis of knee joint anterior cruciate ligament injury in traumatic patients in Sulaimani. Patients and* ***method***: *A cross sectional study carried out in Shar Teaching Hospital from 1st of January to end of August, 2015. All traumatic knee joint patients presented to orthopedic consultancy departments of Shar hospital were the study population.* ***Results***: *There was a significant association between joint effusion and patients with complete ACL tear (p=0.02). There were no significant differences between traumatic knee joint patients with different ACL patterns regarding bone contusion, backer cyst and PCL degeneration (p>0.05). There was a significant association between medial meniscus injury and patients with partial tear (p=0.001).*

Conclusion: *Magnetic resonance imaging is an evaluable non-invasive diagnostic technique for diagnosis of anterior cruciate ligament injury.*

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1 INTRODUCTION

Injuries to the anterior cruciate ligament (ACL) and the medial collateral ligament (MCL) of the knee account for 90% of all knee ligament injuries in young and active individuals. In contrast to the MCL, the primary healing potential of the ACL has been reported to be extremely poor in both clinical and experimental studies [1].

The traumatic or degenerative internal derangement of the knee is a common entity and may require certain studies for the establishment of diagnosis, in addition to clinical history and a thorough physical examination. The use of arthrography and arthroscopy improves the accuracy of the diagnosis; both are invasive and can cause complications. The reported accuracy of arthrography has ranged widely from 67% to 97%, and the technique requires a person who is skilled in reporting and interpreting the results. It also involves exposure to ionizing radiation. Diagnostic arthroscopy is an important advance, improving diagnostic accuracy 64 to 94 per cent. However it is an invasive procedure, with the possible attendant complications of infection, hemarthrosis, adhesions, reflex sympathetic dystrophy [2].

MRI scanning of the knee joint has often been regarded as the noninvasive alternative to diagnostic arthroscopy. MRI scan is routinely used to support the diagnosis for meniscal or cruciate ligament injuries prior to recommending arthroscopic examination and surgery [3]. Magnetic resonance imaging (MRI) findings and degrees of knee joint laxity on physical examination are crucial factors for the diagnosis of anterior cruciate ligament (ACL) injury and the determination of a treatment plan[4, 5]. The structural integrity and stigmata of an injury are best detected by MRI [6, 7]. On the other hand, the degree of laxity should be evaluated by physical examination, including the Lachman test and pivot shift test [8]. The relationships between the imaging and physical examination findings deserve attention because the diagnosis of ACL rupture and surgical indications are dictated by both the disruption of the ligament and the ensuing laxity [7, 9, 10].

Figure 1: MRI of ACL tear.

Multiple primary and secondary MRI findings suggestive of ACL injury are known, but the probability of each finding being positive may vary with the time elapsed from the injury until MRI [11].

A substantial portion of knee joint laxity after ACL injury would be caused by injury to the ligament itself. Thus, primary findings such as nonvisualization, discontinuity, abnormal signal intensity, and abnormal ligament shape are potentially related to the degree of knee joint laxity [12]. Furthermore, bone contusions, a Segond fracture, the deep sulcus sign, a decreased posterior cruciate ligament angle, and the anterior translation of the tibia relative to the femur are secondary findings that may be related to knee joint laxity: the first three may reflect the severity of the injury, while the latter two may be caused directly by the anteriorly displaced tibia. Although MRI is the most valuable imaging method for diagnosing an ACL injury [6, 7], it has a number of inherent disadvantages in that it is a static method and reflects only one time point. In addition, its accuracy can be affected by the time elapsed between the injury and imaging, as the rate of typical MRI findings after ACL injury was reported to change over time [11].

ACL Injury

There have been many methods of studying the mechanism of injury such as video analysis, interviews with injured subjects, cadaver studies, clinical studies, and

mathematical modeling. The typical mechanism of ACL injury occurs with the knee close to full extension and the tibia rotated either internally or externally, leading to a valgus collapse. The most devastating force in this sequence is the anterior translation force when the knee is flexed around 20-30º [13]. A material breaks when the force exceeds its mechanical strength. Similarly, the ACL can be injured when it is subjected to a force that exceeds its strength. These forces that are applied on the knee joint include anterior tibial translation, internal and external tibial rotation, hyperextension of the knee, and valgus rotation of the tibia. Majority of ACL injuries are noncontact in nature, which in turn suggests no direct force applied on the ACL. ACL injury commonly can occur in sports such as football, basketball, soccer and skiing. In the case of skiing, ACL can often get injured in a setting where the anterior tibial translation occurs. As the skier lands, there is a passive drawer force that is applied on the tibia. In order to counteract this force, the quadriceps muscle contract which in turn increase the anterior force on the tibia. The combination of both of these forces often result in ACL injury [14].

Biomechanics of ACL injury

The ACL resists anterior tibial translation during extension and provides rotational stability [15-17]. The anteromedial bundle is taut when the knee is flexed and the posterolateral bundle is taut when the knee is extended [18]. The anteromedial bundle is longest in flexion and may be the primary component that resists anterior displacement of the tibia in flexion. The posterolateral bundle seems primarily to resist anterior tibial translation in extension and also contributes to rotatory stability of the knee joint [17] being employed in the “screw home” phenomenon i.e. during terminal extension of the knee, the tibia externally rotates relative to the femur serving to “lock” the knee in extension. The anteromedial and posterolateral bundles stabilize the knee joint in response to anterior tibial loads and combined rotatory loads in a synergistic way [19]. ACL tears may be partial or complete. Partial tears can range from a minor tear involving just a few fibres to a high grade near-complete tear involving almost all of the ACL fibres. A partial tear can involve both or only a single bundle to varying degree. Sometimes plastic deformity of the ACL without fiber discontinuity can occur causing ACL insufficiency [20].

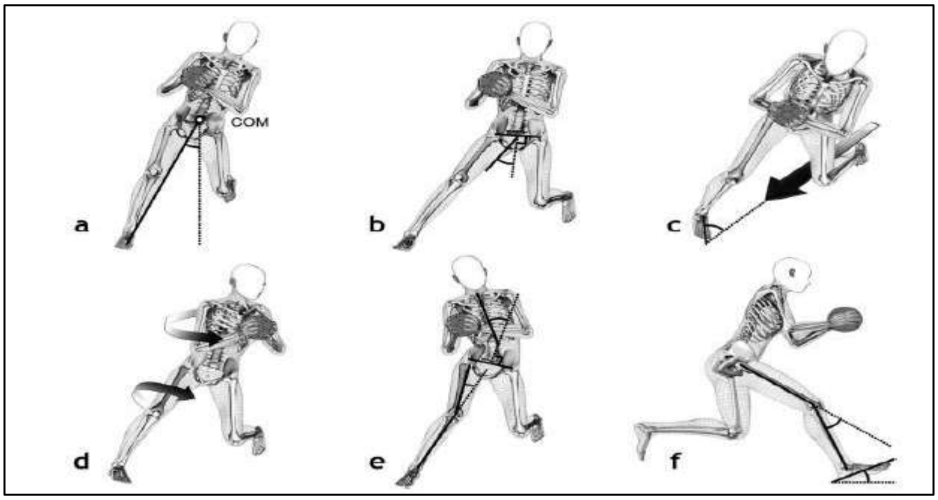

Figure 2: Biomechanical risk factors of ACL.

The mechanism of the ACL injury includes internal rotation of the tibia relative to the femur. This commonly occurs during falls while skiing, as well as in contact sports such as football. With valgus stress, the medial femorotibial joint compartment is distracted producing medial collateral injury and medial meniscal injury (O' Donoghue's triad). Another mechanism of ACL injury is hyperextension such as occurs during jumping or high kick maneuvers and will lead to contra-coup bone contusion on the anterior tibia and femoral condyle. ACL tears resulting from hyperextension frequently occur without concomitant collateral ligament or meniscal injury [21]. The third mechanism is external rotation of the tibia relative to the femur with varus stress leading to impaction and bone oedema medially and distraction laterally resulting in avulsion of the lateral tibial rim (Segond fracture) and tear of the lateral collateral ligament. The majority of the ACL injuries can be diagnosed by history and clinical examination. The anterior drawer test, Lachman test and pivot shift test are the most commonly applied clinical tests to diagnose ACL tear though they do rely both on the experience of the clinician and the degree of patient cooperation. In chronic ACL insufficiency, the pivot shift test has reported high sensitivities for detecting the ACL injury ranging from 84% to 98.4%. The test's specificity has been shown to vary more widely, with reported values from as low as 35% in the alert patient to as high as 98.4% in the anesthetized patient. Anterior drawer and Lachman tests have similar sensitivity but lower specificity. However, in acute injury, if the patient is in

pain or swelling, the examination may be limited and the sensitivity and specificity of the clinical tests are limited [22].

Association injury such as meniscal tear or chondral injury may also limit a full clinical examination. As a result, magnetic resonance imaging (MRI) is helpful in the assessment of suspected ACL injury. Most ACL tears (approximately 80%) are complete, occurring around the middle one-third of the ACL (90%) or less frequently close to the femoral (7%) or tibial (3%) attachments. Less frequently (approximately 20%), ACL tears are incomplete with partial disruption of the ACL fibres. Partial tears may involve only one or both bundles to a varying degree though the anteromedial band does tend to be the more commonly affected. Imaging, and in particular MRI, is very helpful in the assessment of suspected ACL injury [23].

Magnetic Resonance Imaging of ACL

Arthroscopy is considered as "the gold standard" for diagnosis of traumatic intraarticular knee lesions. However, arthroscopy is an invasive procedure that requires hospitalization and anesthesia, thus presenting all the potential complications of a surgical procedure. Since its introduction in the 1980's Magnetic Resonance Imaging (MRI) has gained in popularity as a diagnostic tool of the musculoskeletal disorders. Especially the knee is the most frequent examined joint with MRI. Many surgeons tend to believe that MRI is an accurate, non-invasive diagnostic method of the knee injuries, enough to lead to decisions for conservative treatment and save a patient from unnecessary arthroscopy. Nevertheless, even nowadays, remains very expensive. Taking in account that health-economics play important role in patients management, many questions arise regarding when and how often one must ask for an MRI when clinical examination has already confirmed the diagnosis of meniscal tear or cruciate ligament rupture [24].

Figure 3: T2 sagittal MRI image for 22 years old woman with ACL tear.

MR sequences applied for optimal visualization of the ACL are 2D fast spin echo sequences either with or without fat suppression. Different planes are used for anatomical correlation. In most centers, the sequences used to visualize ACL include Turbo spin echo (TSE) sagittal intermediate weighted sequence either with fat suppression and non-fat suppression, TSE coronal T2 weighted fat suppression sequence and TSE axial intermediate weighted with fat-suppression sequence. In our centre, the standard knee protocol comprises the following three sequences: (1) Coronal T2 weighted fat suppressed sequence; (2) TSE sagittal intermediate weighted sequence; and (3) TSE axial intermediate weighted with fat-suppression sequence. Additional sequences comprise oblique views, flexion views, T1-weighted sequences and small FOV or small coil images when necessary. T1-weighted sequences are useful for suspected fracture or characterizing loose bodies within the knee as any osseous fragments may contain a central marrow component. Small field of view sequences with the small coil placed directly over the area of interest are helpful at delineating peripheral pathology around the knee [25]. Oblique views are helpful in determining the presence, severity and location of ACL tears and will be discussed later. MR images of the knees in flexion can provide more space around the ACL within the intercondylar area, helping to decrease volume-averaging artifact and thereby allowing better visualization of the femoral end of the ligament[26]. Recently 3D fast spin echo imaging with or without suppression has been shown to have the same diagnostic accuracy

as 2D sequences. This can decrease volume averaging artifacts and shorten overall MR examination time [27].

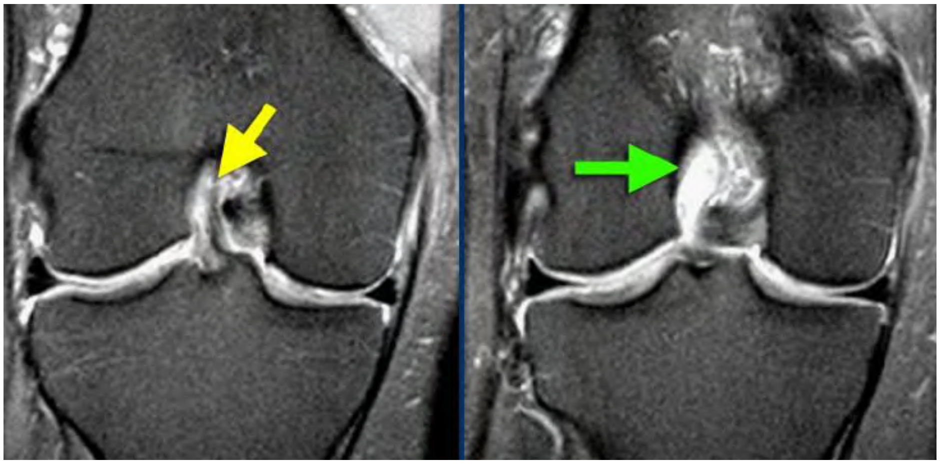

Figure 4: Left: ACL fibers have normal orientation but do not connect to femeurcondyle. Right: Empty notch sign.

The normal ACL should have a taut, low to intermediate signal intensity with continuous fibres in all planes and sequences. It courses parallel or steeper than the intercondylar line. The PL bundle usually has higher signal intensity than the AM bundle. MRI is highly accurate at diagnosing ACL tears with accuracy, sensitivity and specificity of more than 90% [28]. Diagnosis of ACL tear on MR images is usually based on direct signs [29]. The primary sign of ACL tear is fiber discontinuity.

The oblique sagittal plane is the most helpful in diagnosis supported by coronal and axial imaging. The empty notch sign on coronal imaging is a frequent finding in complete ACL tear [30]. In acute or subacute injury, thickening and oedema of the ACL is found characterized by increased signal intensity on T2 or intermediate weighted sequences. In chronic case the fibers can be completely absorbed or the residual ACL stump can become adherent to the synovial envelope covering the posterior cruciate ligament [31]. As the orientation of the ACL makes visualization of the entire ACL in one plane difficult, some authors advocate use of oblique planes either parallel or perpendicular to the ACL to increase ligament and tear conspicuity. Oblique coronal and sagittal views parallel to the ACL have been advocated and found to be effective in improving visualization of the ACL [32-34]. Radiologists have initiated oblique axial imaging of the ACL and found it to very useful in allowing much clearer delineation of the two ACL bundles, and determining the presence,

the location of the normal individual bundle anatomy [34] and possibly individual bundle involvement of partial tears.

A clear potential benefit of imaging in an oblique axial plane is that it allows the ACL to be visualized on 11-15 contiguous images rather than on 2-3 contiguous images as with oblique sagittal or coronal imaging. Partial tears of the ACL are more difficult to diagnose than complete ACL tears. Partial tears are characterized by increased signal intensity and fiber laxity with increased concavity (or bowing) of the ACL. Continuous fibers are evident which suggest the tear is not complete. The sensitivity (40% to 75%) and specificity (51% to 89%) of MRI in the diagnosis of partial tears is poor [35] though this poor performance may be improved by the higher resolution afforded by 3T imaging. A recent study employing 3T MRI reported a sensitivity of 77% and specificity of 97% in detecting partial tears of the ACL [43]. If more than 50% of the ACL fibers are torn this would be considered a high-grade tear, a medium grade tear is 10%-50% of fibers torn, while a low grade tear is less than 10% of fibers torn. The Holy Grail, with respect to imaging of partial ACL tears, would be to have sufficient resolution to determine whether there was a low, medium or high-grade tear in each particular ACL bundle. Potential pitfalls of MR in defining ACL tears are partial volume artifact and reparative fibrosis following an ACL injury bridging the residual ACL stump and adjacent structures, such as femoral notch, the posterior cruciate ligament (PCL) or the synovial envelope covering the PCL. This will help retain a near normal alignment of the ACL and may lead to an ACL appearing to be intact in the previous complete or partial tear. It is conceivable however that such a re-attached ACL may still remain functionally sound and this possibility should be consistently reported. Flexion imaging is particularly helpful in this situation as even 20 degrees of flexion helps change the orientation of central structures in the knee joint to such a degree that the ACL stump can be seen to be adherent to the PCL. Bone bruising is very common in ACL tears. McCauley et al [28] suggested that the presence of bone bruising in the posterior aspect of the tibial plateau and posterior displacement of the posterior horn of the lateral meniscus are highly specific for a torn ACL. However, some authors found that secondary signs such as bone bruising do not help significantly in the diagnosis of ACL tears [36].

A bone bruise is commonly caused by internal rotation in valgus stress injury, where there is impaction of the posterior aspect of the tibial plateau against the mid or anterior portion of the femoral condyle. This abnormal medullary signal intensity is attributed to subcortical microfracture, oedema, or haemorrhage [37]. In the case of anteromedial mechanism of injury or direct compression injuries, the bone bruise pattern is different, such as kissing bone oedema lesions or involving the posteromedial tibial plateau. Bone bruising is a result of impaction at the time of injury. Particularly in young patients who most likely have more elasticity of their ACL fibers, it is distraction and impaction, particularly of the more central rather than posterior aspects of the condyles, that can occur even in the absence of an ACL tear. We would consider bone bruising to be a strong but not absolute indicator of ACL tear. The deep lateral femoral notch sign, although uncommon, is quite specific for ACL tear and is due to impaction injury of the lateral femoral condyle onto the tibia [38].

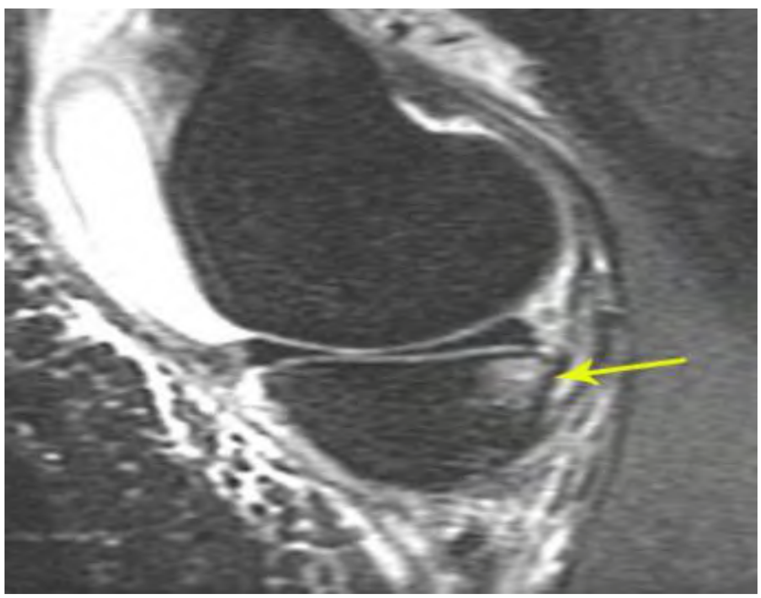

Figure 5: ACL tear with bone bruising.

A notch depth of over 2 mm is diagnostic of ACL tear. Segond fracture is due to avulsion fracture of the iliotibial band, fibular collateral ligament and biceps femoris tendon and can be seen on MRI examination. Bosch-Bock bump relates to a bone excrescence located 2-5 mm below the lateral articular margin of the tibia. This bump indicates a chronic tear of the ACL. Since the function of the ACL is to prevent anterior tibial translation in extension, ACL tear should increase the degree of anterior tibial translation during knee extension

giving rise to “anterior tibial translocation” [39]. It is usually apparent on sagittal MR images at the mid-lateral femoral condyle. If there is ≥ 5 mm anterior translocation of the tibia relative to the femur, this would be indicative of ACL tear (sensitivity 86%, specificity 99%) [40] while an anterior tibial translation > 7 mm is fully diagnostic of ACL tear. Femorotibial translation and rotation gives rise to a host of other signs which are all moderately suggestive of ACL injury such as buckling of the patellar tendon, buckling of the posterior cruciate ligament [41], a posterior PCL line [39], uncovered posterior horn of the medial or lateral meniscus [30] or visibility of the whole posterior cruciate ligament or lateral collateral ligament in one coronal image. Shearing fat pad injury is also associated with ACL tear [29] and results in fracture of the infrapatellar fat pad.

2 PATIENTS AND METHODS

A cross sectional study carried out in Shar Teaching Hospital from 1st of January to end of August, 2015.

Population of study

All traumatic knee joint patients presented to orthopedic consultancy departments of Shar hospital were the study population.

Inclusion criteria: Age more than 12 years, traumatic knee joint cases, and suspected anterior cruciate ligament (ACL) tear.

Exclusion criteria: No history of ACL tears, prior knee surgery or trauma, X-ray with fractures and/or loose bodies, and Osteoarthritis.

Sampling

A convenient sample of 50 traumatic knee joint patients was selected from patients presented to Shar Hospital.

Data collection

The data was collected by researcher through direct interview and fulfilling of prepared questionnaire. All suspected patients were referred from orthopedic surgeon from emergency department or consultancy clinic for imaging. Diagnosis of ACL tear was made by Radiology specialist in Shar Hospital. The researcher made the interview with selected patients, then after, MRI was done. The questionnaire included the followings:

Demographic characteristics (Age and gender), Mechanism of injury, and MRI findings: ACL tear and associated findings.

MRI imaging

The examinations were carried out in a GE 1.5 Tesla Magnetom-Symphony . Sagittal scans of the extended knee (0°) joint were obtained while patients were in supine position using a standard. GE knee coil. The leg was rotated slightly outwardly. It is known that an external rotation of the leg by 15-20° makes it possible to visualize the entire course of the anterior cruciate ligament on sagittal images. The standard imagining protocol included in our study:

1. T1 weighted coronal images slice thickness 2mm , FOV 290 , TE16 TR501
2. T2 weighted sagittal and coronal images FOV 290, TE106 TR 5120
3. T2 weighted proton density and fat suppression sagittal and coronal images FOV 290 , TE14 TR3080
4. On occasions axial views has been done.

Statistical analysis

All patients' data entered using computerized statistical software; Statistical Package for Social Sciences (SPSS) version 17 was used. Descriptive statistics presented as (mean ± standard deviation) and frequencies as percentages. Kolmogorov Smirnov analysis verified the normality of the data set. Multiple contingency tables conducted and appropriate statistical tests performed, Chi-square used for categorical variables (Fishers exact test was used). In all statistical analysis, level of significance (p value) set at ≤ 0.05 and the result presented as tables and/or graphs.

3 | RESULTS

A total of 50 traumatic knee joint patients were included in present study with mean age 37±16 years, 28% of them were aging 30-39 years. Females were more than males with male to female ratio as 9:10. Mechanism of injury for half of studied patients was sport injury, 20% of them caused by fall on ground, 14% previous insult, 8% RTA and 8% twisting force. Right knee joint trauma present among 26 patients and left knee joint trauma present among 24 patients. All

these findings were shown in table 1.

About half (48%) of traumatic knee joint patients were diagnosed by MRI as having partial ACL tear, 32% of them had complete ACL tear and 20% of them had normal ACL. All these findings were shown in table 2.

The frequent associated finding among traumatic knee joint patients was meniscal injury (38%), followed by; joint effusion (32.6%) bone contusion (23.9%), PCL degeneration (3.3%) and backer cyst (2.2%). More than half (60%) of traumatic knee joint patients had medial meniscus injury, 10% of them had both medial and lateral meniscus injury and 30% of them had no meniscal injury. All these findings were shown in table 3.

No significant differences were observed between traumatic knee joint patients with different ACL patterns regarding their age and gender ($p>0.05$), table 4.

There was a significant association between joint effusion and patients with complete ACL tear ($p=0.02$). There were no significant differences between traumatic knee joint patients with different ACL patterns regarding bone contusion, backer cyst and PCL degeneration ($p>0.05$). There was a significant association between medial meniscus injury and patients with partial tear ($p=0.001$). All these findings were shown in table 5.

Table 1: Mechanism and sites of injury.

Variable	No.	%
Mechanism of injury		
Sport injury	25	50.0
RTA	4	8.0
Fall on ground	10	20.0
Twisting force	4	8.0
Previous insult	7	14.0
Total	50	100.0
Site		
Right	26	52.0
Left	24	48.0
Total	50	100.0

Table 2: Distribution of ACL tears.

ACL tear	No.	%
Normal	10	20.0
Partial	24	48.0
Complete	16	32.0
Total	50	100.0

Table 3: Associated findings of traumatic patients.

Variable	No.	%
Associated findings		
Joint effusion	30	32.6
Bone contusion	22	23.9
Backer cyst	2	2.2
MCL injury	0	-
LCL injury	0	-
PCL degeneration	3	3.3
Meniscal injury	35	38.0
Total	93	100.0
Meniscal injury		
No	15	30.0
Medial meniscus	30	60.0
Lateral meniscus	0	-
Both	5	10.0
Total	50	100.0

Table 4: Distribution of demographic characteristics according to ACL tear.

Variable	Normal		Partial		Complete		χ^2	P
	No.	%	No.	%	No.	%		
Age							2.7*	0.9
< 20 years	2	20.0	3	12.5	2	12.5		
20-29 years	2	20.0	5	20.8	4	25.0		
30-39 years	2	20.0	6	25.0	6	37.5		
40-49 years	2	20.0	3	12.5	1	6.3		
≥ 50 years	2	20.0	7	29.2	3	18.7		
Gender							4.4	0.1
Male	3	30.0	10	41.7	11	68.7		
Female	7	70.0	14	58.3	5	31.3		

**Fishers exact test.*

Table 5: Distribution of associated findings according to ACL tear.

Variable	Normal		Partial		Complete		χ^2	P
	No.	%	No.	%	No.	%		
Joint effusion							7.7	**0.02**
Yes	4	40.0	12	50.0	14	87.5		
No	6	60.0	12	50.0	2	12.5		
Bone contusion							3.4	0.1
Yes	3	30.0	9	37.5	10	62.5		
No	7	70.0	15	62.5	6	37.5		
Backer cyst							2.5*	0.3
Yes	0	-	2	8.3	0	-		
No	10	100.0	22	91.7	16	100.0		
PCL degeneration							0.8*	0.6
Yes	0	-	2	8.3	1	6.3		
No	10	100.0	22	91.7	15	93.8		
Meniscal injury							18.6*	**0.001**
No	8	80.0	4	16.7	3	18.8		
Medial meniscus	1	10.0	16	66.6	13	81.2		
Both medial & lateral	1	10.0	4	16.7	0	-		

**Fishers exact test.*

4 DISCUSSION

Females with traumatic knee joints in present study were more than males. This is consistent with results of Heidari B study in Iran (2012) [42]. For ACL tear, females were also more than males. It has been reported that female gender is an important risk factor to the occurrence of ACL injury [43]. Additionally, female sex has been reported to have an association with radiographic knee OA after ACL tear [44]. Recent data has also demonstrated that female gender has a marked effect (hazard ratio of 1.58 compared to male gender) on the risk of post-ACL reconstruction patients requiring knee arthroplasty after fifteen years [45].

Half of studied traumatic knee joint injury patients and ACL tear in present study had sport injury as mechanism of knee injury with predominance of right knee joint. This finding agreed with results of Nikolaou VS, et al study in UK (2008) [24]. Over the past 2 decades, several studies have been carried out to understand the anatomy, function, and mechanical properties of the ACL. Because of advances in surgical techniques and rehabilitation, reconstruction of the ACL has become a relatively routine procedure. However, although an understanding of the etiology of ACL injuries is essential to develop effective prevention methods, little attention has been focused on the injury mechanisms of these injuries in team sports. Injured players report that the injuries often occur in a cutting movement or landing from a jump and, apparently, without direct body contact [46]. Myklebust et al [47] reported on the mechanisms of ACL injury on a total of 115 injuries (male and female) in 2 studies and found that 95% and 89% of the players reported that the injuries occurred without player-to player contact.

Imaging with MRI for traumatic knee joint patients in our study found that 48% of them had partial ACL tear and 32% of them had complete ACL tear. These findings are close to results of Yaqoob J, et al study in Saudi Arabia (2015) [48]. The knee is the most frequent examined joint with MRI. Many surgeons tend to believe that MRI is an accurate, non invasive diagnostic method of the knee injuries, enough to lead to decisions for conservative treatment and save a patient from unnecessary arthroscopy. Nevertheless, even nowadays, remains very expensive. Taking in account that health-economics play important role in patients management, many questions arise regarding when and how often one must ask for an MRI when clinical examination has already confirm the diagnosis of meniscal tear or cruciate ligament rupture [49].

The common associated finding detected by MRI for traumatic knee joint patients in our study was meniscal injury (38%) and commonly medical meniscal injury (60%). These findings close to results of Alharis NR and Hameed AM study in Iraq (2012) [50] which found prevalence of meniscal injury among traumatic knee joint patients as 28.8% and more commonly medial meniscal injury (69%). A meniscal tear is a frequent orthopedic diagnosis and arthroscopic partial menisctomy is the most frequent surgical procedure for high grade tears in patients 45 year of age or older. People in whom this procedure has been performed are at increased risk of knee osteoarthritis; which is one of the most common causes of musculoskeletal disability in developed countries [51]. There was a significant association between patients with partial ACL tear detected by MRI in present study and medial meniscal injury (p=0.001). This is similar to results of Behairy NH, et al study in Egypt (2009) [52] and Nikolaou VS, et al study in UK (2008) [24]. The meniscus is frequently damaged in ACL injuries or in the degenerative process over a period of several years. The predominance of lateral meniscal tears has been demonstrated with acute ACL rupture, whereas the incidence of medial meniscal tears significantly increases with chronic ACL insufficiency [53].

Joint effusion was common associated finding in present study with statistically significant association with patients diagnosed by MRI as complete ACL tear (p=0.02). This finding is similar to results of Yoon JP, et al study in South Korea (2013) [10]. Joint effusion is used for determination of chronic ACL injury by MRI. The temporal patterns of the 4 MRI findings with chronological significance are well known by the previous studies involving ACL morphology, joint effusion, PCL angle, and bone bruise which were also documented synthetically in a previous study [10].

5 │CONCLUSIONS

Magnetic resonance imaging is an evaluable non-invasive diagnostic technique for diagnosis of anterior cruciate ligament injury.

Ethical Issue:

All ethical issues were approved by the author, in accordance with Ethical Principles of Declaration of Helsinki of the world Medical Association, 2013, for research involving human subjects

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